DOCUMENT RESUME

ED 062 416 TM 001 584

TITLE	Barrel-Arbor Assembler (clock & watch) 6-72.134; Burrer (clock & watch) 6-72.274; Burrer, Machine (clock & watch) 6-72.275; Lancing Gager (clock & watch) 8-72.10; Main-Arbor-and-Hook Assembler (clock & watch) 8-72.10; Pinion Reamer (clock & watch) 8-72.10; Reamer (clock & watch) 6-78.210; Retaining-Spring Attacher (clock & watch) 8-72.10; Rocking-Bar Adjuster (clock & watch) 8-72.10; Staker (clock & watch) 6-72.111; Straightener (clock & watch) 6-72.246; Tray Leader (clock & watch) 8-72.10
REPCRT NO	TR-S-152
PUB DATE	Mar 59
NOTE	12p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Aptitude Tests; Assembly (Manufacturing); *Cutting Scores; Evaluation Criteria; Job Applicants; *Job Skills; Norms; Occupational Guidance; *Personnel Evaluation; Skilled Occupations; Test Reliability; Test Validity; *Watchmakers
IDENTIFIERS	GATB; *General Aptitude Test Battery

ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

FILMED FROM BEST AVAILABLE COPY

ED 062416

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

BARREL-ARBOR ASSEMBLER (clock & watch) 6-72.134
BURRER (clock & watch) 6-72.274
BURRER, MACHINE (clock & watch) 6-72.275
LANCING GAGER (clock & watch) 8-72.10
MAIN-ARBOR-AND-HOOK ASSEMBLER (clock & watch) 8-72.10
PINION REAMER (clock & watch) 8-72.10
REAMER (clock & watch) 6-78.210
RETAINING-SPRING ATTACHER (clock & watch) 8-72.10
ROCKING-BAR ADJUSTER (clock & watch) 8-72.10
STAKER (clock & watch) 6-72.111
STRAIGHTENER (clock & watch) 6-72.246
TRAY LEADER (clock & watch) 8-72.10

(SUB-ASSEMBLY-OTHER DEPARTMENT)

B-416

TM 001 564

U. S. Employment Service in
Cooperation with
Texas State Employment Service

U. S. DEPARTMENT OF LABOR
~~Bureau of Employment Security~~
Washington 25, D.C.
March 1959

FILMED FROM BEST AVAILABLE COPY

GATB #2217
February 1958

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR WATCH ASSEMBLY OCCUPATIONS IN THE SUB-ASSEMBLY-OTHER DEPARTMENT

-B-416-

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 56 women employed in the Sub-Assembly-Other Department at the U. S. Time Company, Abilene, Texas. The occupations covered in the Sub-Assembly-Other Department are as follows:

Barrel-Arbor Assembler
Burrer
Burrer, Machine
Lancing Gager
Main-Arbor-and-Hook Assembler
Pinion Reamer
Reamer
Retaining-Spring Attacher
Rocking-Bar Adjuster
Staker
Straightener
Tray Leader

Watch-making jobs

The criterion consisted of broad category supervisory ratings. On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes S-Spatial Aptitude, P-Form Perception, K-Motor Coordination, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Watch Assembly Occupations in the Sub-Assembly-Other Department

S-152

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Watch Assembly Occupations in the Sub-Assembly-Other Department.

FILMED FROM BEST AVAILABLE COPY

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S [illegible].

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1-F CB-1-H	90	S	Part 3	85
P	CB-1-A CB-1-L	90	P	Part 5 Part 7	90
T	CB-1-G CB-1-K	75	K	Part 8	80
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV indicate that 15 of the 19 poor workers, or 79 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 79 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 33 of the 37 workers who made qualifying test scores, or 89 percent, were good workers.

FILMED FROM BEST AVAILABLE COPY

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for Watch Assembly Occupations in the Sub-Assembly-Other Department.

II. Sample

The General Aptitude Test Battery, B-1002A, was administered during the period December 10, 1957 to February 10, 1958 to a sample of 57 women employed in the Sub-Assembly-Other Department, U. S. Time Company, Abilene, Texas. These workers were shifted about in the entire Sub-Assembly-Other Department. All the workers had completed an on-the-job training program. One woman was eliminated from the sample because she had less than six years education. Therefore, the final experimental sample consisted of 56 women.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations (corrected for broad categories) with the criterion for age, education, and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_c r$) for Age, Education, and Experience

Watch Assembly Occupations in the
Sub-Assembly-Other Department
N = 56

	M	σ	Range	$_c r$
Age (years)	28.3	7.2	17-42	-.203
Education (years)	10.9	1.7	6-16	-.087
Experience (months)	24.8	19.4	2-77	-.468**

** Significant at the .01 level

There are no significant correlations between age or education and the criterion. The negative correlation between experience and the criterion is significant at the .01 level. No reasonable explanation for the significant negative correlation between experience and the criterion can be offered.

FILMED FROM BEST AVAILABLE COPY

III. Job Descriptions

Job Titles:
Barrel-Arbor Assembler 6-72.134
Burrer 6-72.274
Burrer, Machine 6-72.275
Lancing Gager 8-72.10
Main-Arbor-and-Hook Assembler 8-72.10
Pinion Reamer 8-72.10
Reamer 6-78.210
Retaining-Spring Attacher 8-72.10
Rocking-Bar Adjuster 8-72.10
Staker 6-72.111
Straightener 6-72.246
Tray Leader 8-72.10

watch and higgit

BARREL-ARBOR ASSEMBLER
Job Summary: Using tweezers, inserts main arbor in barrel of watch movement.

Work Performed: Picks up barrel of watch movement from table and places it in nest of block. Picks up arbor and hook assembly from tray with tweezers and places it in slot of mainspring on barrel. Holds arbor with tweezers and twirls barrel in nest until arbor catches mainspring and winds it slightly. Removes barrel from nest and places it on barrel tray.

BURRER
Job Summary: Smooths and knocks burrs with a pick from regulator bushing. Checks regulator and all assemblies for defects and malfunctioning.

Work Performed: Picks up tray of back frames and empties back frames on stand. Picks up back frame and runs pick around regulator bushing to smooth and knock burrs off bushing. Moves regulator to check for freeness and tension and to check to see if there is slot in end of regulator. Rejects all assemblies with malfunctioning or irregular parts and places rejects in reject tray.

BURRER, MACHINE
Job Summary: Using a burring machine, burrs and checks regulators.

Work Performed: Picks up back frame of watch movement from work table of machine and fits into nest of burring machine. Presses foot pedal to bring blade of machine down on regulator stud to knock off rough edges or burrs. Removes assembly from nest of machine with one hand, places another assembly in nest of machine with other hand.

LANCING GAGER
Job Summary: Using a lancing gage, checks height of lancing from back frame of watch movement. Also checks frame for flaws.

Work Performed: Picks up back frame from pile on table and inserts lancing gage under lancing on inside of back frame. Checks to see that lancing sets at specified height from frame. Turns frame over and checks it for flaws. Rejects frames with lancing too low or too high or with any noticeable flaw in frame.

FILMED FROM BEST AVAILABLE COPY

MAIN-ARBOR-AND HOOK ASSEMBLER
Job Summary: Assembles hook on arbor using a driving machine.

Work Performed: Picks up arbor from tray using tweezers and places it, large end down, in nest of driving machine. Presses it into nest with forefinger. Picks up hook from tray using tweezers and places it over arbor in nest of machine. Kicks foot pedal of machine to bring upper part of die down over arbor to press hook down on arbor. Removes assembly, using tweezers, from nest of machine and places it in finish tray.

PINION REAMER
Job Summary: Reams minute wheel pinion using an electric reaming machine.

Work Performed: Flips switch to start reaming machine. Picks up minute wheel with tweezers and places it in nest of reaming machine with pinion up. Pulls down on lever to lower reaming blade down through pinion in minute wheel holding minute wheel while reaming is done. Removes reamed assembly and places it in finish tray.

REAMER
Job Summary: Reams socket in hour wheel using an electric reaming machine.

Work Performed: Slides hour wheel to edge of tray and picks it up. Places hour wheel with socket side down in nest of machine. Closes check by pressing pedal. Pulls lever to lower reaming bit through hole in socket. Lifts bit to raise reaming bit from hole in socket. Presses foot pedal to release chuck and allow air to eject assembly from nest.

RETAINING-SPRING ATTACHER
Job Summary: Attaches retaining spring to back frame of watch movement with a screw using a jeweler's screwdriver.

Work Performed: Picks up back frame of watch movement and places it inside down in nest of assembly block. Picks up retaining spring, using tweezers, and places it on outside of back frame hooking one end of spring in hole in frame and fitting hole in spring over hole in frame. Picks up screw with jeweler's screwdriver and screws it into frame through hole in spring. Removes assembly from nest.

ROCKING-BAR ADJUSTER
Job Summary: Applies pressure to straighten front frame of watch movement slightly to release rocking-bar pressure on frame.

Work Performed: Picks up front frame of watch movement that has been rejected because rocking-bar binds on frame. Places thumb on interwind and winding set wheels on outside of frame; two fingers on inside of frame and applies pressure to straighten frame slightly to release rocking-bar pressure on frame. Turns interwinding and winding set wheels with thumb to see that they turn freely. Checks rocking-bar to see that it will rock freely. May have to reject process if binding still occurs.

FILMED FROM BEST AVAILABLE COPY

STAKER

Job Summary: Using a staking machine, flares end of balance stud, drives balance stud into balance screw, spreads hour wheel socket to hold it in hour wheel, stakes hairspring bracket and stem bearing bracket to back frame. On front frame of watch movement, puts click, places interwind wheels and winding set wheel on outside of frame, puts rocking-bar inside of frame, attaches rocking-bar spring, stakes minute wheel and pillars to frame and stakes click spring to inside of frame. Using a driving machine, drives center wheel onto arbor, and attaches regulator and regulator bushing to back frame of watch movement.

Work Performed: Picks up balance stud from tray with tweezers and places it, flat side up, in nest of staking machine. Picks up regulator bushing from tray, with tweezers, and places it, small end down, in nest of machine over balance stud. Straightens pieces in nest with finger. Presses air pedal with foot to release punch part of staking machine and flare end of balance stud. Removes assembly from nest of machine.

Picks up balance stud from tray with tweezers and places it flat side up in nest of staking machine. Picks up balance screw with tweezers from tray and places it grooved side up over balance stud in nest of staking machine. Kicks pedal to bring punch down on assembly in nest and drive stud into balance screw. Removes assembly from nest of machine.

Picks up hour wheel socket from tray using tweezers and places it hollow end up in nest of staking machine. Picks up hour wheel from tray and places in nest of staking machine over socket with depressed side up. Kicks pedal to bring down punch on hollow end of socket and spread socket to hold it in hour wheel. Removes assembly from nest of machine.

Picks up hairspring bracket from tray using tweezers and places hole in bracket over pin in nest of staking machine. Picks up back frame of watch movement from stack on table and places it, inside down, in nest of machine fitting pin in nest into hairspring hole in frame. Kicks pedal of machine to bring punch down onto nest to stake hairspring bracket to back frame of watch movement.

Picks up stem bearing bracket, using tweezers, from tray and places hole in bracket over pin in nest of staking machine. Picks up back frame of watch movement and places it, inside down, over holding pin in nest of staking machine. Kicks foot pedal of machine to bring punch down on stem bearing bracket, and stakes stem bearing bracket to back frame. Removes assembly from nest of machine.

Takes click stud from tray with tweezers and sticks stud in hole in nest of staking machine. Takes click from tray and places click on stud using tweezers; fits front frame over stud. Kicks foot pedal to bring stripper and stake down on stud to brad stud. Removes assembly from nest. Turns click with tweezers to see that it turns freely. Places it in plastic tray. Rejects assembly if binding occurs and places rejects in reject tray.

FILMED FROM BEST AVAILABLE COPY

Uses tweezers to pick up and place three studs in block in nest of machine. Picks up two winding pinions and places one on each of two end studs. Picks up intermid wheel and places it on middle stud. Places front frame over studs with outside down and places rocking-bar on studs on inside of frame. Kicks pedal of machine to bring stripper and stake down on studs to brad. Removes assembly from nest. Checks rocking-bar for freeness from bind and places assembly in tray.

Places stud in die in nest of staking machine and places rocking-bar spring and washer on stud using tweezers. Places frame in nest, front side down, and fits frame over stud. Kicks pedal to bring stripper and stake down on stud and brad stud. Removes frame from nest and hooks one end of spring on long stud on end of rocking-bar. Places the assembled part in finish tray.

Picks up arbor with tweezers from tray and fits it, large end down, in nest of driving machine. Slides center wheel to edge of tray and picks it up. Places center wheel, pinion up, in nest fitting hole in wheel over arbor. Kicks pedal to lower plunger of driving machine and drive center wheel onto arbor. Removes assembly from nest and places it in tray.

Picks up regulator bushing from tray with tweezers and places it in hole in nest of machine. Picks up regulator from tray with tweezers and fits it over bushing in nest of machine. Picks up back frame of watch movement and places it outside down in nest of driving machine. Kicks foot pedal to bring punch down onto and drive bushing of stud assembly to back frame. Removes assembly from nest of machine.

Picks up stud from tray using tweezers and places it in nest of staking machine. Takes minute wheel from tray, using tweezers, and fits it over stud. Picks up front frame of watch movement and places it over stud and minute wheel. Kicks foot pedal to bring down stripper and punch of machine to brad stud. Removes assembly from nest and turns minute wheel with tweezers to see that it turns freely. Places assembly in tray or rejects assembly and places it in reject tray.

Takes three pillars from tray, using tweezers and places them with staking stud up in nest of staking machine. Picks up front frame of watch movement. Checks to see that rocking-bar spring is securely fastened to frame. Places it inside down over pillars in nest of machine. Hits buttons with both hands at same time to bring down stripper and punch of air press type staking machine to brad pillars on front frame of watch movement. Presses foot pedal to release air into nest of machine to eject assembly from nest. Places assembly in tray.

Picks up stud from tray using tweezers and places it in nest of staking machine. Picks up click spring from tray with tweezers and places it over stud in nest of machine with ends of spring pointing toward outer edge of nest. Picks up front frame of watch movement and positions click with tweezers. Places front frame over stud and click spring in nest of machine. Kicks foot pedal to bring stripper and punch down on stud to brad stud. Picks up assembly from nest of machine and places end of click spring through hole in frame, by click, using tweezers; places assembly in tray. Checks assembly for defects and rejects defective assemblies.

FILMED FROM BEST AVAILABLE COPY

STRAIGHTENER
Job Summary: Using a truing block, straightens third, fourth, center, or escape wheel that has been rejected. Repeats truing operation if it is needed, and rejects wheels that cannot be trued.

Work Performed: Adjusts truing block by turning knob to set holding block of machine for wheels to be trued. Picks up third, fourth, center or escape wheel that have been rejected from tray and places it in holding block of truing block fitting staff in slots that will allow wheel to turn. Turns wheel with fingers and watches it using a loupe. Detects part of wheel that is untrue. Applies slight amount of pressure to wheel with fingers to spring outer edge of wheel until it will run true in block. Rechecks wheel by turning it in block again and repeats truing operation if it is needed. Rejects wheels that cannot be trued and places trued wheels in tray. Checks to see that wheel is driven flush with shoulder of pinion.

TRAY LEADER
Job Summary: Places watch movement wheels in insert trays by hand.

Work Performed: Empties wheels with pinions inserted on insert tray. Turns wheels so they will fit into tray with specific side up (different for different wheels). Moves wheel on insert tray with fingers to fit staff into holes of tray. Places 50 wheels in each insert tray and places filled insert tray in wheel tray. Goes to storage cabinet to get wheels to be trayed and tray. May clean trays with air blower.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion for this study consisted of broad category supervisory ratings. The Sub-Assembly-Other Department foreman and the plant superintendent rated each worker on her ability to perform assigned duties in jobs in the Sub-Assembly-Other Department. The rating was a composite, overall evaluation by the foreman and the plant superintendent. The workers were placed in one of three categories--"good," "average," or "poor." This placed 18 workers in the "good" group, 19 in the "average" group, and 19 in the "poor" group. For computational purposes the qualitative ratings were converted to quantitative scores of 61, 50, and 39 for the good, average, and poor groups, respectively.

VI. Statistical and Qualitative Analyses

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working populationsnorms with a mean of 100 and a standard deviation of 20.

FILMED FROM BEST AVAILABLE COPY

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_c r$) for the Aptitudes of the GATB

Watch Assembly Occupations in the Sub-Assembly-Other Department
N = 56

Aptitudes	M	σ	$_c r$
G-Intelligence	95.5	15.7	.487**
V-Verbal Aptitude	94.4	15.7	.309*
N-Numerical Aptitude	89.1	18.9	.458**
S-Spatial Aptitude	102.1#	18.0	.498**
P-Form Perception	101.7#	17.5	.423**
Q-Clerical Perception	98.2	14.4	.413**
K-Motor Coordination	98.6	15.2	.478**
F-Finger Dexterity	99.5	16.4	.321*
M-Manual Dexterity	97.0	16.9	.501**

** Significant at the .01 level.
* Significant at the .05 level.
# Relatively high mean score.

The highest mean scores in descending order of magnitude were obtained for Aptitudes S and P. All the aptitudes have standard deviations of less than 20. Aptitude Q has the lowest standard deviation.

For a sample of 56 cases, correlations of .342 and .264 are significant at the .01 level and the .05 level of confidence, respectively. All the aptitudes correlate significantly with the criterion at the .01 level except Aptitudes V and F; Aptitudes V and F correlate significantly with the criterion at the .05 level.

B. Qualitative Analysis:

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Spatial Aptitude (S) and Form Perception (P) - required to place parts in driving nest of driving machine; to position hour wheel in nest of machine; to check back frame of watch movement and regulator for defects.

Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) - required to handle small watch movements with fingers, tweezers, and/or a jeweler's screwdriver; to handle back frame of watch movement and operate burring machine fast and accurately; to clean trays with air blower.

FILMED FROM BEST AVAILABLE COPY

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes S, P, K, F, and M warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
S	X	X	X
P	X	X	X
K		X	X
F		X	X
M		X	X

Although each of the other aptitudes (G, V, N, and Q) showed significant correlations with the criterion, none were considered further for inclusion in the norms because there was no other quantitative and qualitative evidence of significance.

Various combinations of Aptitudes S, P, K, F, and M, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII) was determined.

A comparison of the results showed that B-1002 norms consisting of S-85, P-90, K-80, and M-75 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 6 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized with those workers rated as Good and Average placed in the high criterion group, and with those rated as Poor placed in the low criterion group. This resulted in 19 of the 56 workers, or 34 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes S, P, K, and M with critical scores of 85, 90, 80, and 75, respectively, and the dichotomized criterion for Watch Assembly Occupations in the Sub-Assembly-Other Department. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

FILMED FROM BEST AVAILABLE COPY

TABLE IV

Relationship between Test Norms Consisting of Aptitudes S, P, K, and M with Critical Scores of 85, 90, 80, and 75, Respectively, and the Criterion for Watch Assembly Occupations in the Sub-Assembly-Other Department

N = 56

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	4	33	37
Poor Workers	15	4	19
Total	19	37	56

$r_{tet} = .89$ $\quad X^2 = 23.048$

$\sigma_{r_{tet}} = .22$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes S, P, K, and M with minimum scores of 85, 90, 80, and 75, respectively, are recommended as B-1002 norms for Watch Assembly Occupations in the Sub-Assembly-Other Department. The equivalent B-1001 norms consist of S-90, P-90, K-75, and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation includes four aptitudes, only those occupational aptitude patterns which include three of those four aptitudes with cutting scores that are within ten points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns meeting these criteria for this study is OAP-15, which consists of P-85, K-80, and M-80 for B-1002 and P-85, T-80, and M-85 for B-1001. The selective efficiency of OAP-15 for this sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .84 with a standard error of .23 was obtained. This indicates a significant relationship between OAP-15 and the criterion for the experimental sample. The proportion of the sample screened out by OAP-15 was .27, which is within the required range of .10 to .60. Therefore, OAP-15 is recommended for use in counseling for Watch Assembly Occupations in the Sub-Assembly-Other Department.